Prepared for Review of
Scientific Instruments
March 1963

X63-12026

USE OF POLAROID FILM IN X-RAY DIFFRACTION

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E-2104

For sometime Polaroid film (ASA 3000) has been used for diffraction studies, where its speed and convenience measureably increased the output of a laboratory. Smith used this film backed with X-ray sensitive phosphors to obtain pictures where short exposure time and rapid film processing were vital and accurate relative intensities were unimportant.[1] With the advent of Polaroid film type 410 (ASA 10,000) the fluorescent screens can be eliminated, which simplifies the camera and yet retains a favorable overall process speed.

We have adapted the Polaroid film holder No. 2620 as a Laue camera for the GE XRD-5 X-ray apparatus (fig. 1). The aluminum camera holder satisfies the necessary geometric considerations and retains the beam collimator when the camera is used for back-reflection photographs. The holder is secured to the camera track by two set screws. For transmission patterns, a separate holder is used for the collimator. The block is designed for use with the specimen holder shown. A 3-cm film-to-sample distance is obtained when the two parts are brought together. The bottom of the film holder is cut out to facilitate $\pm 20^{\circ}$ movement of the sample about the vertical axis and $\pm 30^{\circ}$ about the horizontal axis. The film holder is held rigidly in place by mating with two pins in the aluminum base. This also permits the rapid removal and accurate replacement of the holder. Since the X-ray beam must pass through the film holder for back-reflection studies, holes have been

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appropriately drilled in the camera and light-sealed with paper. Then the beam passes only through paper and two negatives, all of which reduces the intensity approximately 30 percent for copper and 10 percent for molybdenum radiation. An undesirable effect, however, is the production of a large central spot on the film due to fluorescence of both the paper and the film in the direct beam.

This camera has been used almost exclusively to determine the orientation of single-crystal films and substrates and to align crystals for precise cutting. In figure 2, examples are shown of back-reflection pictures of MgO crystals with the X-ray beam normal to the (011) and (111) planes for a copper target, 50 KVP, 40-ma, and 4-min exposures. The exposure times are comparable to those used for standard cameras and film. Acceptable pictures can be obtained for exposures to about 0.5 min. The principle attraction of this camera, therefore, lies in the 10-sec developing time, which saves 30 to 45 min over the usual negative processing time. Figure 3 shows typical transmission patterns of a 1-mm sapphire plate and an 0.0008-in. aluminum foil with the same copper target mentioned previously and for 3-min exposures.

The quality of the patterns obtained with this relatively coarse-grained Polaroid film is satisfactory for most orientation work, and the accuracy is well within the 1° generally associated with the routine Laue technique.

REFERENCE

1. Smith, H. G. P., Rev. Sci. Instr., 33, 128 (1962).

FIGURE LEGENDS

(a) Complete camera mounted on GE XRD-5 camera track.

Figure 1. - Polaroid X-ray diffraction camera used in back-reflection mode.

(b) Details of aluminum camera holder.

Figure 1. - Concluded. Polaroid X-ray diffraction camera used in back-reflection mode.

(a) Beam normal to the (011) plane.

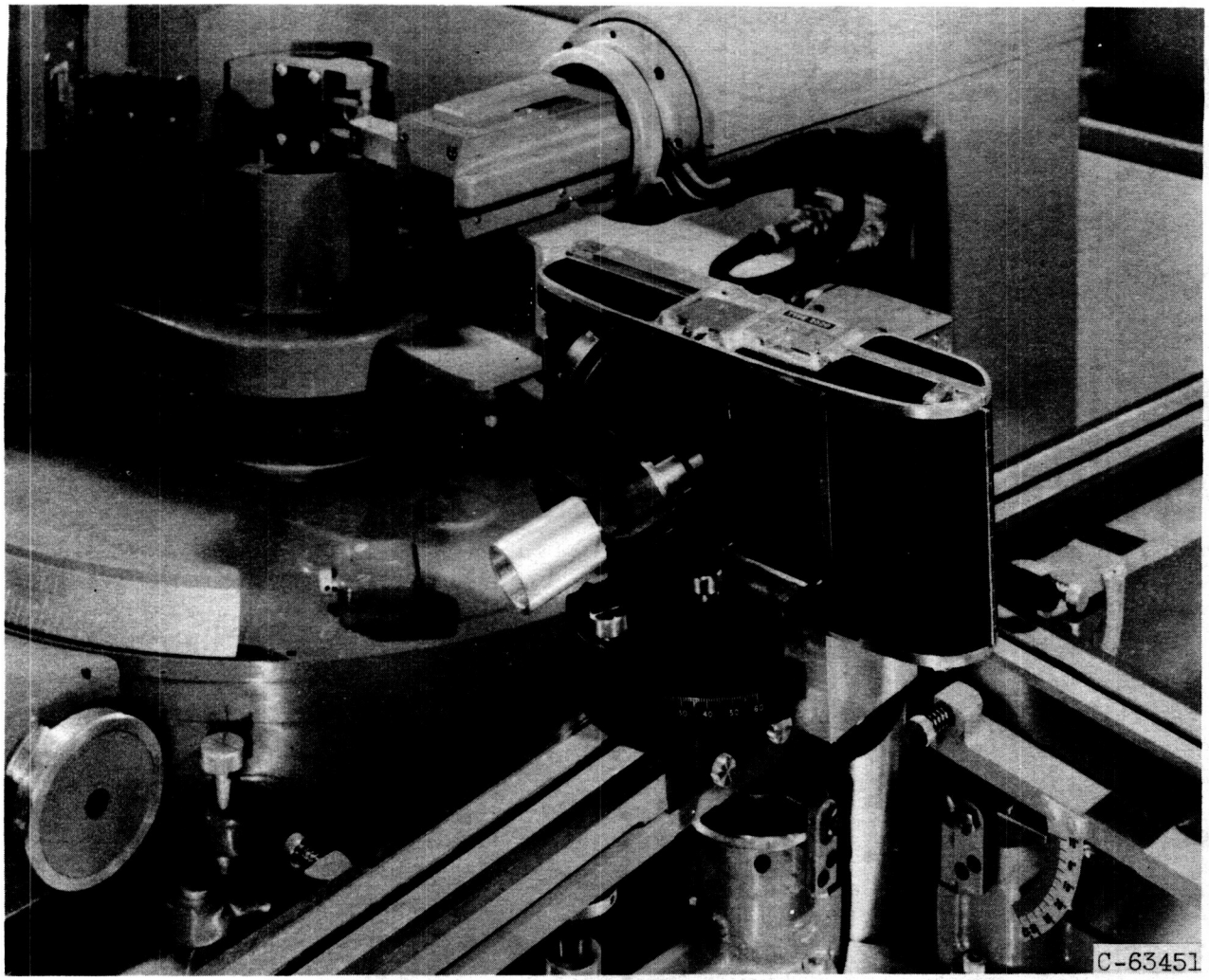
(b) Beam normal to the (111) plane.

Figure 2. - Typical back-reflection Laue patterns of a MgO single crystal.

(a) Copper target, 50 KVP, 40 ma, 3-cm film-to-sample distance, 3-min exposure, 1-mm sapphire single-crystal plate.

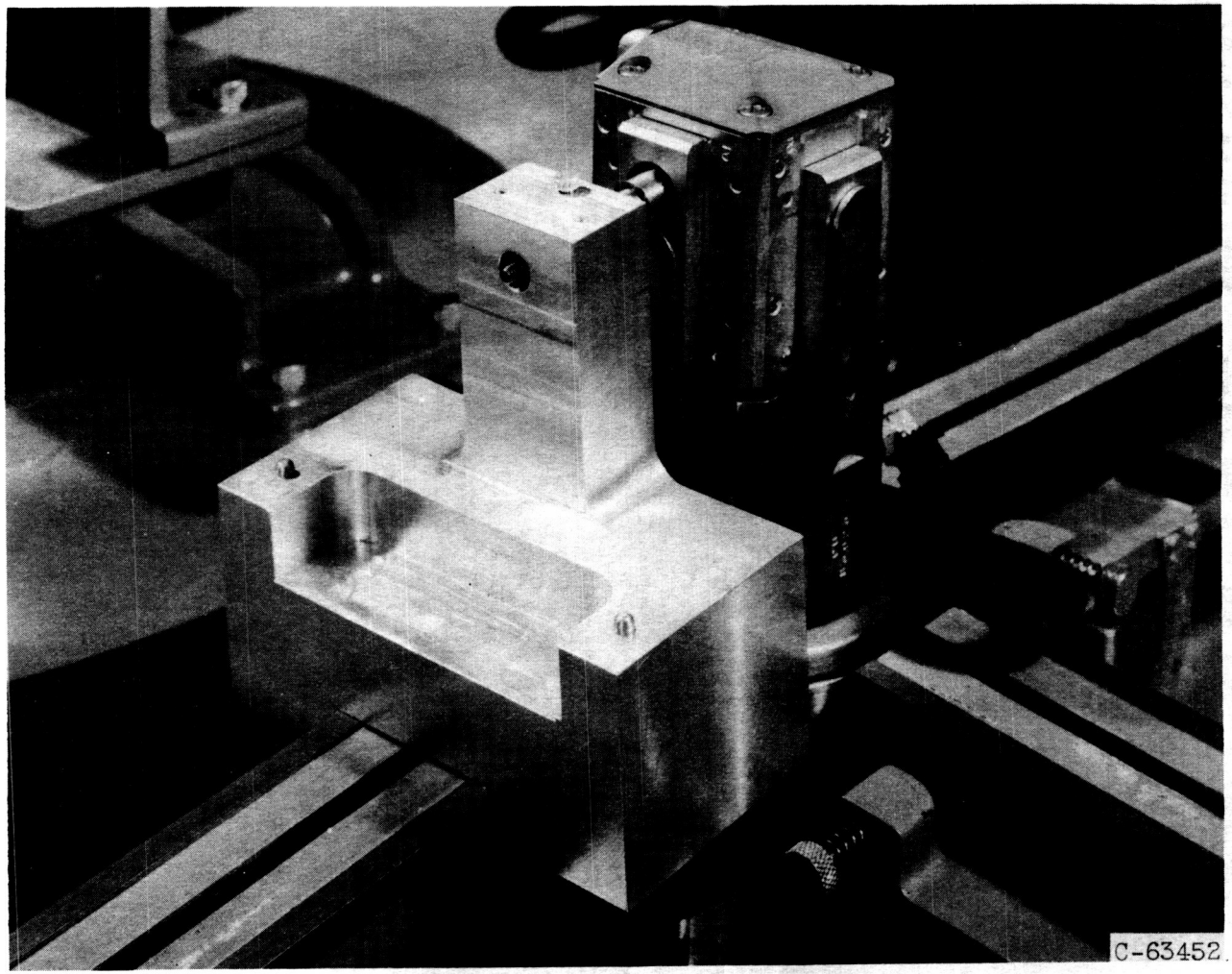
(b) 0.0008-in. aluminum foil.

Figure 3. - Typical transmission Laue patterns.



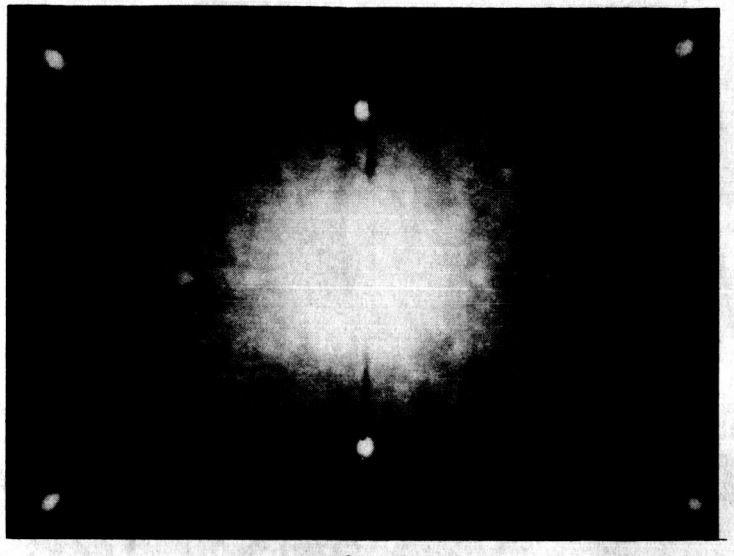
(a) Complete camera mounted on a GE XRD-5 camera track.

Figure 1. - Polaroid X-ray diffraction camera used in back-reflection mode.

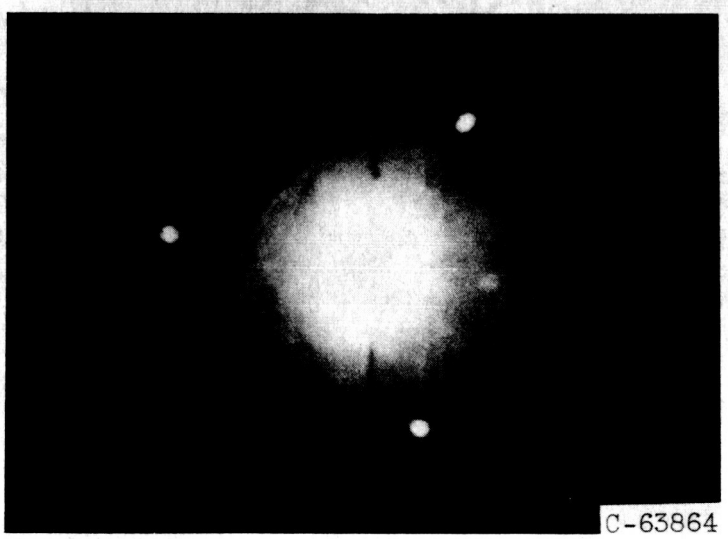


(b) Details of aluminum camera holder.

Figure 1. - Concluded. Polaroid X-ray diffraction camera used in back-reflection mode.



(a)

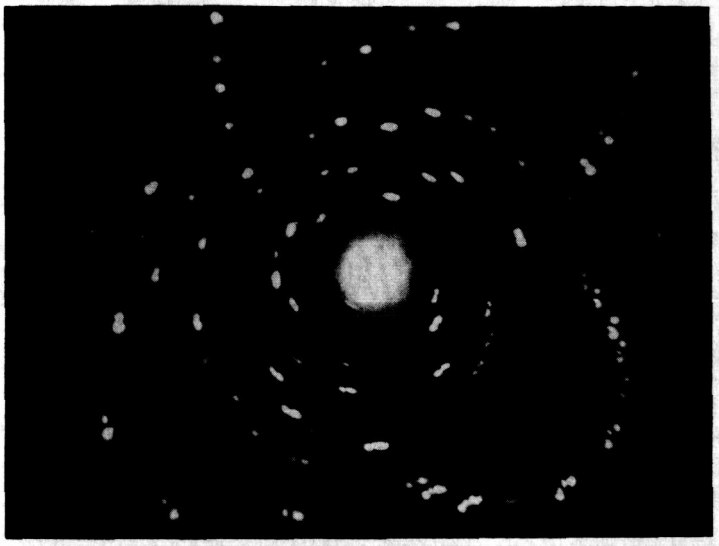


(b)

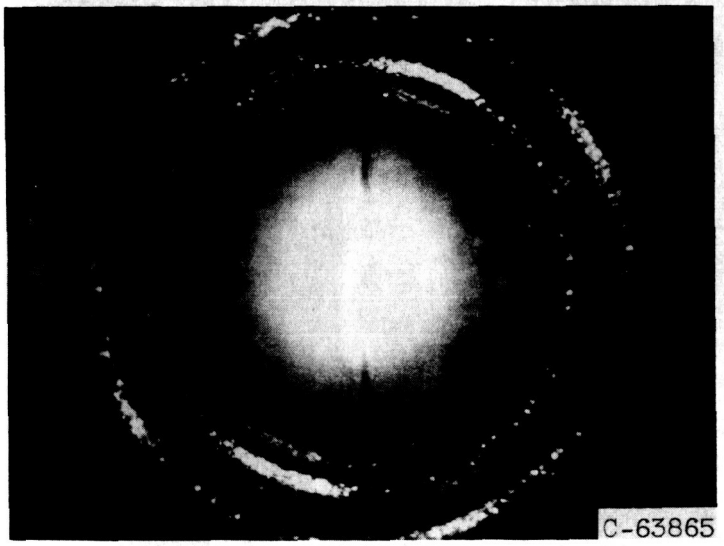
(a) Beam normal to the (011) plane.

(b) Beam normal to the (111) plane.

Figure 2. - Typical back-reflection Laue patterns of a MgO single crystal.



(a)



(b)

(a) Copper target, 50 KVP, 40 ma, 3-cm film-to-sample distance, 3-min exposure, 1-mm sapphire single-crystal plate.

(b) 0.0008-in. aluminum foil.

Figure 3. - Typical transmission Laue patterns.